THE WORK OF THE NATURALIST IN THE WORLD

BY

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By Prof. CHARLES SEDGWICK MINOT.

THERE can be no broader question, touching us all, than the influence of our profession upon the world. With your permission I will present a series of considerations in regard to our professional careers which ought, in my opinion, to receive more attention than hitherto. I am aware that in doing this I depart very far from our custom, your previous presidents having each dealt with some broad but specific problem of natural history in their formal addresses. I must leave it to your judgment whether or not I have done wisely in not following, in the present address, the example of my distinguished predecessors.

The object of the naturalist is to discover the truth about Nature, and to record his discoveries in a form which will render them available to others. Original research is the pivot of knowledge.

We will examine:

First. The conditions of success in research.

Second. The effect of the naturalist's career on his character.

Third. The influence of the naturalist on mankind.

I. The Conditions of Success in Research.—That the fundamental condition is the love of truth goes without saying. It is an axiom which, before this audience, requires no proof. But, though we all acknowledge Truth to be our sovereign, I fear there is not one of us whose loyalty to her is perfect—not one of us who can say that his allegiance to the truth has never swerved

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for the sake of competing influences. Yet Truth is the most absolute of despots, and if any man adheres to Error instead, Truth will triumph over him at last and rob him of all the honor which he thought to win. The disloyal investigator may for a time win honor, but in the end the falsity of his claims becomes known and his reputation shrivels. In our own time we have seen the German founder of brilliant embryological theories lose caste because he did not have the discretion to wait to learn whether his ideas were true. Certain great naturalists have suffered in reputation from their inability to accept Darwinian theories, for, had it been possible for them to join with Darwin, their greatness would be to us still greater. A man may be of the highest ability, yet will he rank low among naturalists unless he is quick and sure in his recognition and inflexible in his devotion to truth.

Perfect truth is our ideal, but we encounter so many, many obstacles that we do not attain the ideal. The practical question is, What are these obstacles, and how may they be removed, avoided, or overcome? We undoubtedly make many failures, which are inevitable, and for which we are not responsible; I mean such failures as are due to the present limits of scientific knowledge, and the lack of the methods and instruments of research, which are as yet in the future. Nevertheless, the majority of failures to find the absolute truth are due to our own personal deficiencies. It is to the correction and, if possible, removal of these deficiencies that our professional training is very rightly directed.

The naturalist should be trained in observation, experimentation, and in reasoning.

Observation is our mainstay, the foundation of all our work. I believe that in many of our laboratories a student becomes well disciplined in observation, and acquires practical acquaintance with the principal sources of error in observation in his special line of work. This part of the naturalist's education is the part best done, and we must regretfully admit that his training in experimentation is almost nil, while his training in reasoning power leaves very much to be desired.

I should like to plead before you for experimentation. It is a most difficult art—far more difficult than that of observation, because the possibilities of error are far greater. The observer inquires "What?" the experimenter "Why?" The experimenter endeavors to determine an effect and a cause. He seeks, if you will allow me the expression, to find two "whats" and their mutual relation. Every science begins with observation, and, when it is advanced enough, takes to experiments. Natural history is still in the descriptive stage. The statement is almost strictly true of meteorology and zoölogy, nearly so of geology,

least so of botany. I attribute so great value to experimental work that I regard botany as being at the present time the most valuable of the natural-history sciences from an educational point of view. As regards the zoölogists—with whom I must be counted—we are most of us either systematists or morphologists. Such experimental physiological work as has been done stands not to the credit of zoölogists, but almost entirely to that of medical men. In the slow advance of experimental morphology, through the labors of Driesch, Hertwig, Morgan, Roux, Whitman, Wilson, and others, we have the initiation of a most significant and beneficent reform. In all natural-history departments the great work of the future will, I believe, be done by experimenters.

For this reason it is to be desired earnestly that all young naturalists should be disciplined in making experiments. When that is done we shall hear less phylogenetic speculation and more of true causes. There are still many morphologists who feel that they have somehow explained matters when, for example, they state that the human embryo has gill-clefts *because* man is descended from a fishlike ancestor. In reality such a statement is no explanation of the causation, any more than it would explain vegetable humus to say that it is due to vegetable matter deposited on the ground. Such assertions may be true, but the omission of all links between the initial cause and the terminal effect shows that the notion of causation is in its rudimentary stage. There are too many naturalists who have still to develop a just conception of cause and effect; and it is just this development that we must look for in connection with experimental work. The biologists especially ought to profit more than they do by the opportunities offered in physiological laboratories.

The reasoning faculty is our weak point. Of the late Prof. Helmholtz, his friend, the physiologist Carl Ludwig, once remarked to me, "*Er ist eine reine Denkmaschine.*" It was the possession of a superlative reasoning faculty that rendered Helmholtz to many of us the foremost scientific man of his time. Most of us certainly find that, when we try to reason, our reasoning is disturbed by various personal factors, and, though we know that emotional factors must be eliminated from intellectual processes if our conclusions are to be sure, yet experience has taught us that logic in our practice is rarely divorced from all emotion. Sound reasoning involves the character of the individual. To train a naturalist, it is even more important to perfect his character than his intellect. For this reason no teacher can deal advantageously with more than a few students, because he must understand the individual characteristics, and give each man personal guidance, which necessarily is different for each student.

Let us consider some of the factors which are most apt to disturb or distort the work of reason.

First and foremost is the love of one's own observations and opinions. If it takes the form of pride, which leads us to be so careful that our opinions deserve trust, well and good; but if it is merely an excitable vanity, it lures us to disaster. Think of the innumerable controversies of science, and tell me how often have the disputants cared less to prove themselves right, than to ascertain the truth, be their own opinions right or wrong. What we strive for and, I fear, never attain is perfect indifference to the sources of an idea. It is almost impossible not to feel an undue interest in our own idea, yet such an interest inevitably leads to overvaluation of the evidence in favor of our idea, and undervaluation of the evidence against it. Let us, therefore, avoid polemics, and so avoid the temptation to search for proof of a personal theory, when we ought to search for the truth only. Never let a pupil say: "I am sorry it did not turn out thus and so; it would have been so fine if it only had been so." Let him be glad at discovering the truth. When he is eager for controversy, teach him the difference between discussion and controversy, and keep him out of the latter. Point out to him that erroneous conclusions are to be set aside, not so much by disproving them as by demonstrating the true conclusion. Darwin's theory of pangenesis has been set aside, not by being disproved, but by the demonstration that the theory of germinal continuity is well founded. The cataclysmic theories of Adam Sedgwick and the older geologists have been overthrown by the accumulated proofs of the gradual character of geologic changes. An error is hard to kill, but with a truth you may drive it away; therefore research is better than controversy.

The love of one's own opinion is the most insidious and fruitful of all sources of human error, and accordingly we recognize vanity and self-conceit as the gravest of defects in the naturalist's character. It is easier to make a competent investigator out of a dull man than out of a conceited man.

A second source of error is impatience—impatience to get results before the data are sufficient to support conclusions. What a horrible record against this century has been piled up by the accumulation of "preliminary notices," "*vorläufige Mittheilungen*, and *notes préventives!*"—a vast mass of mistakes, a terrible impediment to science, and all to gratify the mad longing for priority. I wish that the publication of a preliminary notice to secure priority should disqualify for membership in this society, and I trust that every one of us will stand firmly and sternly against this abuse, which is doing more to degrade science than any other influence I know of. Indeed, I am almost ready to say

that the Académie des Sciences at Paris has done more against science than for science, because in its Comptes-Rendus it initiated the custom of brief premature publication for priority.

A third difficulty in the way of reason is the tendency to speculate. The annual waste of cerebral protoplasm in speculation must amount to millions of pounds. A vast generalization has its allurements, but in yielding to them we are apt to be drawn away from the actual facts. There is another danger, for the mere lapse of time gives hypotheses a dignity and apparent worth, and it were easy to give illustrations. You are doubtless all familiar with the hypothesis of *panmixia*, which was advanced on the flimsiest of bases; yet a few years later its propounder treats it as an established law. The like misfortune might happen to any of us, since it is easy to remember the conclusion and to forget the evidence. Among zoölogists speculation has long been rife, and for many years we have been deluged with phylogenetic inferences, with the evil accompaniment of eager welcome for facts which agree with the favorite phylogenetic theories of the day, and of disdain for such facts as did not concord with these theories. Thus has been created that biological mythology against which Prof. E. B. Wilson has protested so suitably.

Philosophy and science are practically often incompatible—not because philosophy is unworthy of our entire respect, but because would-be philosophers are not seekers for wisdom but lovers of speculation. Twenty years ago we thought that Oken, whose *Natur-philosophie* was created by his speculative enthusiasm, would never have another imitator, but since then biological speculation has become almost a fetich. Let us part company from the horde of foolish thoughts which have too long masqueraded under the false garb of philosophy. For our lifetimes the labor of inductive research will suffice, and we may well leave deduction for future generations. Philosophy, so called, is often an effort to decide what must be, but while knowledge remains imperfect the "must be's" will guide us wrong more frequently than they will guide us aright. As long as Science seeks to determine what *is*, her work will endure. My protest against speculation is no idle rhetoric, for the evil is very great. I hope that Weismann's mystical treatise on Germplasm will prove to be the culminating effort of the speculative school, and that the influence of the school will be as brief as it has been widespread.

A hypothesis may be a good serving maid to clean away rubbish and get the workroom in order. It is for us to remember that this good maid makes the worst mistress.

There are many other difficulties of character which obstruct reason, but you will excuse me from an exhaustive review of them, and therefore I will refer only to one more, and that briefly.

I mean the artistic perception which induces us to look for completeness, clearness, and simplicity, so that we are tempted to add a little or more to our conclusions, or to accept a result partly because it is complete, clear, and simple. The most eminent illustration of this tendency is Herbert Spencer, whose mental processes are so far governed by his love of clear, simple formulæ that he uses simplicity as a test of his conclusions, and makes formulation a test of truth and a substitute for proof. We are all inclined to be lax as to our proofs if the generalization is satisfactory and pleasing, but Spencer's mistakes may warn us against the danger of gratifying this inclination. Science is not one of the fine arts. Its work can not be directed by the love of beauty or by sentiments. Science is a pursuit for the intellect and for the intellect alone.

I will turn to another part of our work—publication. Scientific publications naturally group themselves in four classes: original memoirs, handbooks, text-books, and bibliographies. Now in the three latter good workmanship is indispensable, for their utility depends on their arrangement, the right proportion of parts, and the skillful use of language; but the value of original memoirs depends upon the discoveries which they report and the sufficiency of the evidence presented to support the discoveries claimed; hence the form in which the matter is presented appears less important than in a handbook or text-book. Moreover, our original memoirs, saving a very few which mark epochs of progress in natural science, are, as we all perfectly know, destined to oblivion. In time our new discoveries will become old-established facts, the original authorities for which will be forgotten. Who of us would search, save as a student of the history of science, for the original authority on the muscles of the human arm, or for the proof that fossils are not *lusus naturæ* but genuine remains, or that some rocks are of sedimentary origin? When we have attained certainty in our discoveries, they gradually become so verified that the memoirs, which originally brought the proofs, lose their value. Original memoirs are like digestive organs; they are filled with raw facts, which they prepare for assimilation, but to build the body of science these same facts must be absorbed and transmuted.

We are, of course, convinced that our original memoirs are for temporary service, though their recorded facts are to be permanently added to knowledge. To the influence of this conviction we may ascribe that carelessness of style, verbosity, and frequent padding which mar scientific writings too commonly, because the necessary care does not appear worth while for a temporary essay. But the time has now come when the burden of reading the thousands of pages of memoirs which are published annually

even in a single field of research is overwhelming, and it is evident that for the advantage of science every legitimate means to lessen this heavy burden should be adopted. The habit of conciseness and clearness should be sedulously cultivated.

With a view of estimating what might be done in this direction, I have gone over a number of articles upon embryology which have been published in the four accepted languages of science—German, English, French, and Italian—during the last two years. I am compelled to admit that the majority of these articles could be easily shortened by a half, and many of them shortened by much more than that, and still offer a thorough, or, better, said an exhaustive account of the matter presented. I have been astonished at the amount of perfectly irrelevant matter and of personal details which appears. The author informs us that he could not leave home until Tuesday; that it rained on Friday; that he had to carry the eggs eleven kilometres on Saturday; that he used Delafield's hæmatoxyline solution, of which he gives the formula; that he began making his sections with a Thoma microtome, but later used a Schanze, as Prof. X—needed the Thoma; the author's work was interrupted because he was called home on account of his father's illness; his father lived in Meyerstadt or Smithville. What have these and thousands of similar items to do with the plane of the first cleavage of the ovum, the origin of the centrosome, or the development of the notochord, or any other problem of embryology? I have not invented my illustrations; on the contrary, I have taken them from some of the best of recent embryological articles. Similar illustrations can be collected from recent literature of any branch of natural-history research.

So far as embryological literature is concerned, the French standard is certainly the lowest. Their verbosity is infinite, and one must read page after page for a single fact. Many of the French memoirs I have read are literally ten times too long for the matter. Next to the French come the Germans and ourselves —Americans—who, in the biological sciences, are disciples of the Germans. The best-written memoirs are the English, owing, I think, to Huxley's influence. Huxley has carried scientific writing to unsurpassed excellence, combining clearness and brevity in a marvelous way, and his pupils, Francis Balfour and Michael Foster, have invariably sustained a high literary standard. Their example has been all the more telling because literary art holds the same position in England that music holds in Germany and painting in France.

No doubt the ark of science will traverse the deluge of publication safely and land us on the Ararat of natural law, but I fear our Ararat will not appear until the deluge subsides.

But I must hasten to the second part of my address.

II. THE EFFECT OF THE NATURALIST'S CAREER ON HIS CHARACTER.—The occasion does not permit me to refer to more than two or three professional traits.

The best that we gain from the pursuit of research is, I believe, our characteristic optimism. We are engaged in achieving results, and results of the most permanent and enduring quality. A business man may achieve a fortune; but time will dissipate it. A statesman may be the savior of a nation; but how long do nations live? Knowledge has no country, belongs to no class, but is the might of mankind, and it is mightier for what each of us has done. We have brought our stones, and they are built into the edifice and into its grandeur. My stone is a small one. It will certainly be forgotten that it is mine, nevertheless it will remain in place.

How different is the pessimism toward which literary men are seen to tend! Harvard University lost James Russell Lowell in 1891, and Asa Gray in 1888. The letters of both of these eminent men have been published. Lowell's letters grow sad and discouraged, and he gives way more and more to the pessimistic spirit. Gray is optimistic steadily and to the end. The difference was partly due to natural temperament, but chiefly, I think, to the influence of their respective professions. The subject material of the literary man is familiar human nature and familiar human surroundings, and his task is to express the thoughts and dreams which these suggest. He must compete with the whole past, with all the genius that has been. There is nothing new under the sun, he exclaims. But to us it is a proverb contradicted by our daily experience.

The attitude of literary men is indeed sad. Lowell opens his essay on Chaucer with the question, "Can any one hope to say anything, not new, but even fresh, on a topic so well worn?" and answers, "It may well be doubted." This feeling that anything new is impossible is not modern. La Bruyère begins his Caractères with "Tout est dit, et l'on vient trop tard depuis plus de sept mille ans qu'il y a des hommes, et qui pensent"; and two hundred years later Joubert repeats: "Toutes les choses, qui sont aisées à bien dire, ont été parfaitement dites; le reste est notre affaire ou notre tâche: tâche pénible."

Another trait which is very striking shows itself, not in all naturalists, but in nearly all great naturalists—the trait of humility—not the humility of self-depreciation, but the humility which is the privilege of those who pursue a high ideal. The great naturalist cares for the absolulely true, and, though he may know that he is abler than other men, he feels only a minor interest in personal comparison, and measures himself by a different stand-

ard. A man who estimates himself by an ideal which he never fully attains, learns humility in its noblest form. Von Baer, Ernst Heinrich Weber, Helmholtz, and Darwin were men of that rank; and doubtless the very greatness mentally of such men enables them to estimate justly the proportion their personal contributions bear to the whole of science.

The sad side of an investigator's life is its inevitable loneliness, so far as his special work is concerned. It rarely happens that one of us finds a colleague at hand able to appreciate his special work; but at these meetings we each find appreciation and stimulus, and we return refreshed to our isolated labors, return stronger to stand by ourselves, as men must who wish to share in the serious work of the world.

The solidarity of our profession, the mutual loyalty not only of naturalists but of all scientific men, is very great and of immense value. It is perhaps the most important function of this society to maintain and strengthen our professional loyalty, because upon that loyalty depends our success as a body, and as a body we have a great work to do. Loyalty implies generous co-operation, and secures that unity of feeling and action which breeds success. Our influence is not yet large enough, and I hope that it will be vastly increased by carrying out the scheme of affiliation between ourselves and kindred societies. Unity is power.

It is believed by many outside of our profession that a scientific career is narrowing in effect, and tends to obliterate human, artistic, and religious interests. They look upon Darwin's loss of sympathy with poetry as typical. The idea seems to me false. The naturalists whom I know are as genuinely interested in their friends and in art and in literature as any other group of liberally educated men. One of our foremost geologists is a learned musical enthusiast; one of our botanists, a loving student of the best European literature; one of our anatomists, an earnest participant in charitable work. I claim, in short, that the pursuit of pure science broadens and deepens the character. Science is full of sublimity, of charm, of inspiration; but the poet has not yet been found who will express this aspect of science. We are like colonists: our pioneers are continually advancing into new territories; we must work incessantly to secure mere possession; so it is not yet quite time for the poet.

Another characteristic of the naturalist is faith. He must preserve his faith in the possibility and value of knowledge of the truth. We often forget that this necessity exists. Although we know not whither truth will lead us, whether to happiness or to unhappiness, we nevertheless believe in it, trust in it, and strive for it. Let us therefore have a broad-minded respect for

the faculty of faith, for the loss of it is a crushing disaster to a naturalist.

The loss of faith in the truth is rare; its opposite, an exaggerated confidence in the possibilities of science, is not rare. I think that we habitually measure science incorrectly, because we estimate its magnitude by our individual capacity for knowledge, and so come thoughtlessly to call that infinite which is merely large. I hold the opposite conception, that the extent of possible human knowledge is comparatively small so soon as we omit the details. Huet, Bishop of Avranches, thought that the real knowledge of his time,* aside from the details of history, etc., could be put in ten folio volumes. He was probably not far from right. All the knowledge of our time could be brought within the compass of a moderate number of volumes. Nor does the future appear to me to offer more than very finite possibilities. Discovery can not always go on with its present rapidity. We live in the golden age of research. We are surrounded on every side by discoveries so easy that they seem to beg for our attention. But as each one is made and its result added to the known, the unknown is equally diminished. It diminishes daily, and the store of easy discoveries lessens so fast that the time is not very distant when investigators of moderate abilities will no longer enjoy such opportunities as they have now. If we consider the whole of science, we have a sense of boundlessness; but each part has its end, and its end is not far away. It will not be long before nearly everything easily known will be known. It would be presumptuous to assume that, even when the whole knowable has become known, there will not still be problems which the human intellect can apprehend but not solve. As to-day, so hereafter, the naturalist's final thought must be reverent submission.

III. The Influence of the Naturalist on Mankind.—The influence and utility of natural science need neither defense nor explanation to a generation which has witnessed the establishment of the theory of natural selection and of the germ theory of disease; nor need we argue for the pre-eminence of original research, but there are certain principles for which we stand individually and collectively. I think that it will be profitable to review and to formulate some of these.

We stand for the value of good intellectual work and for the recognition of the value of proper training. We do not admit that scientific work requires a peculiar mind, but only the cultivation of those fundamental faculties of observation and induction which every one should possess and use. On the other hand, we claim that in addition to the development and disciplining of

* The latter part of the reign of Louis XIV.

these faculties the naturalist must have his special professional training, and that without it he is not qualified for his professional work. In upholding this standard we not only serve the cause of science, but we serve the whole country. It is safe to say that the greatest evil in the social life of the United States is the habitual disregard of competency—a disregard which prevails not only with the people at large, but also among the most highly educated men. Democracy is the belief that every man is the equal of his betters. Americans are loath to admit that training and experience make experts, and that experts are better than others for their special work. The spoils system of the office-seekers is based upon the assumption that training and experience do not render a man more competent. When a water board is established to plan a water supply, we do not appoint chemists, engineers, and sanitarians, but grocers, novelists, and ward politicians. It is a rare exception if among the trustees of endowed educational institutions a man is found with extensive knowledge of educational methods. It is common for a man who has never been trained to teach to take up teaching for a few years, when he changes to some business or profession. These, and thousands of other instances, crowded in our memories, illustrate the dislike of real competency.

Imagination anticipates the revolution which must come, and foresees the time when public workers of all kinds shall be chosen —first, because they have been properly trained and educated for the work which is to be their lifelong profession; second, according to the relative ability of those so prepared. Democracy appears as a permanent factor of steadily increasing influence in social evolution. It has, of course, done much good, but its failure to secure honest government has raised one of the gravest problems of our time. Some persons advocate restriction of the right to vote, but to me restriction of the right to be a candidate offers the practicable solution of the problem. We are a few among millions, but the educational and other offices we hold give us an influence out of proportion to our mere numbers. If we demand within the limits which becomes us that men must be chosen for their competency, we shall uphold effectively a principle the defense of which is among the foremost duties of every patriotic citizen.

We have already done something to improve school education. We should do more, especially in the direction of adding scientific courses to the school curriculum. A man is liberally educated when he has learned to take an appreciative interest in the intellectual life of his time, and a man who has not learned enough of the natural sciences to understand something of their progress can to-day scarcely rank as an educated man. It is true

that science is better adapted to serve as a basis of education than the classics, and it is true also that it is easier to give a liberal education without classics than without science; nevertheless we must urge the claims of science in schools conservatively. A reform is better than a revolution. A reform saves strength and spares prejudices. We must remember, too, that centuries have been spent in testing and perfecting the classical system of education, and that it has rendered services which can hardly be overestimated. The education based on science has scarcely two decades of imperfect and hesitating trial, and the people at large have still to learn that it is feasible and more valuable than the older system. The methods of utilizing science for school courses are still crude. We suffer from an *embarras des richesses*. There is here an opportunity for public usefulness for this society. Could we not through a committee prepare a plan for a system of school education in which science should have its place, and by which our children should acquire some information about themselves, the world around them, and at the same time be disciplined in observation and reasoning?

In regard to our schools there prevails the miserable delusion that they are good. We have many private and public good schools, but they constitute the small minority. Most of the young men who enter my classes after leaving our public schools are poorly disciplined in every respect, and a great many of them are absolutely uneducated: they can not express their thoughts in English; they can not spell common words; they can not translate correctly a simple phrase in Latin or any modern language, and they are ignorant of all sciences. Such is too often the condition of the graduates of the primary, grammar, and high schools of the country which claims to afford the best system of public education in the world. I have very little personal acquaintance with our schools, but to my mind their product condemns them, and I believe that our influence can do much to redeem them from their present condition.

Another public duty, which belongs especially to us, is to advance the development of universities in America. There are three grades of education—school, college, and university. In schools elementary knowledge is used to inform and develop the mind; in colleges advanced knowledge is used for the same purposes. Now it is one thing to teach what is known, as in schools, and to teach how to confirm what is known, as in colleges; but it is a fundamentally different task to advance a student to successful original investigation of the unknown. As Mill has justly remarked, the vast majority of mental operations are neither inductive nor deductive, but reasoning from particular to the particular. Minds which work in this way suffice for the routine

affairs of existence, but the progress of the world depends on the higher faculty of originality, either in the inductive establishment of laws by the comparison of particulars or in the deductive applications of these laws. It is the function of universities to develop and discipline originality, to cultivate the faculty of thinking out a conclusion for the first time—not for the first time in the history of the thinker, but for the first time in the history of the world.

To train men to originality in every field of production is the proper function of a true university. This has long been the accepted ideal of German universities, and because they have steadily striven for this ideal they have attained a fame which draws to them students from every other country. In America we are slowly creating a few universities. Of nominal universities we have too many—false *Duessas*, fair in semblance, but not true to their pretensions. We have, in fact, as yet nothing to rank with the German universities. We are handicapped by the college tradition of four years' education to fit a man for everything in general and nothing in particular. But the colleges are rapidly losing ground, and it seems to be only a question of time as to their total disappearance. I do not mean that they will cease to exist in name, but that a college (in the sense of the term as universally accepted thirty years ago) is an institution which will have no place in the American educational system of the future, just as it is unknown in the present educational system of Europe. In fact, our best colleges are passing through rapid revolutionary changes, and, like Harvard, Yale, Columbia, and others, are becoming universities. Let it be our part to help the transformation, to hasten it, and to secure for research its place as the basis of the highest education in science. Every one admits that the value of a university depends chiefly upon its professors, but it is not understood that ability to give instruction six to ten hours a week successfully by no means qualifies a man to be a university professor. The essential qualifications for a professor of any natural science are, first, ability to carry on original research; second, ability to train others to carry on original research. All other qualifications are subsidiary. Of university life research is the Alpha and research is the Omega.

We welcome the growth of the university idea in this country, and we can not gather in this place without speaking with grateful recognition of the services rendered to the cause of the highest education by the university whose guests we are to-day. The Johns Hopkins University has the glory of having been the first American institution to accept unreservedly the genuine university ideal. Would that she had had more imitators!